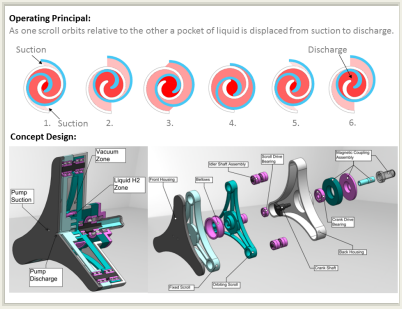
Small Business Innovation Research/Small Business Tech Transfer

Small Scroll Pump for Cryogenic Liquids, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

The innovation is a compact, reliable, light weight, electrically driven pump capable of pumping cryogenic liquids, based on scroll pump technology. This pump will fulfill several needs stated in SBIR Research Topic, H2.01: Cryogenic Fluid Management Technologies. Zero gravity cryogenic control devices (spray bars and mixers), require cryogenic liquids to be pumped efficiently. Propellant conditioning and densification technologies require compact, efficient pumps. Broad area cooling of cryopropellant shields can be facilitated by the pumping of a cold gas such as helium in a loop from a cryocooler to a shield. Various methods of liquefaction of oxygen such as passive radiative cooling can be enabled by cryogenic pumping. Other aerospace applications such as a fuel pump for liquid hydrogen fueled aircraft. A compact, reliable, and light weight pump for cryogenic liquids currently does not exist. Our subcontractor, Ball Aerospace and Technologies, has identified the need for such a pump several years ago, but has not found a suitable available product. Scroll pumps have several advantages over other pump technology, including being compact, light weight, reliable and efficient. The pump can be hermetically isolated from the drive motor by the use of a magnetic coupler, allowing the pump to be hermetically sealed. Because of the orbital motion, the scrolls can be placed in a metal bellows that are sealed to the housing which isolates the liquid via a vacuum enclosure for thermal isolation. The bearings can be placed on thermally isolating arms, so they do not need to operate at cryogenic temperatures. Scroll pumps have considerable technical heritage relevant to this application. Air Squared has developed and successfully tested scroll pumps for liquids and for cryogenic gasses. Air Squared has developed several compact pumps for pumping air which has similar viscosity and compressibility to liquid hydrogen.



Small Scroll Pump for Cryogenic Liquids

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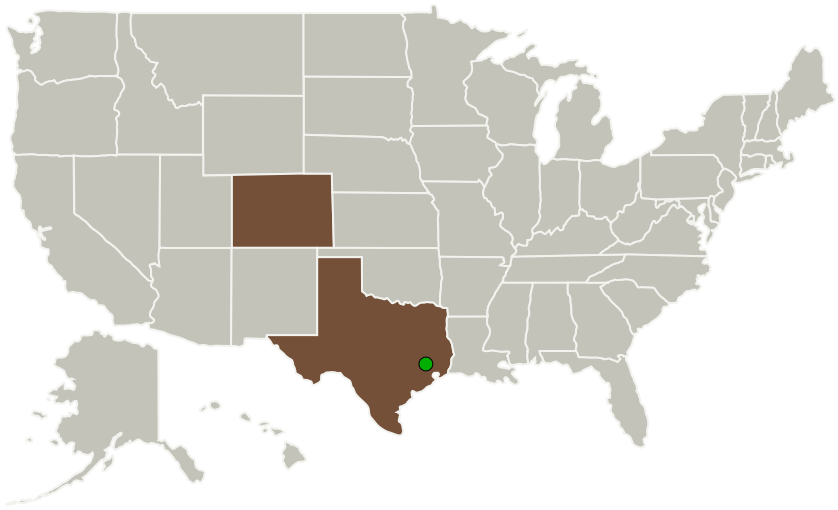
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Air Squared Inc.	Lead Organization	Industry	Broomfield, Colorado
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Colorado	Texas

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138512)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Air Squared Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Bryce Shaffer

Co-Investigator:

Bryce Shaffer

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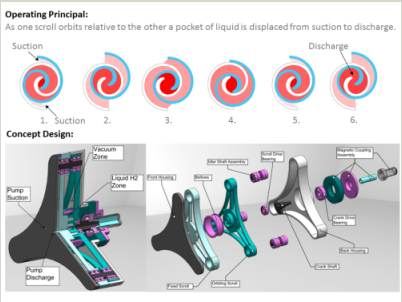
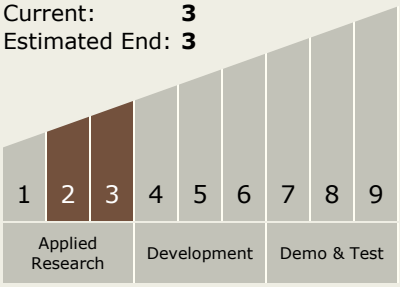
Images



Project Image
Small Scroll Pump for Cryogenic Liquids
(https://techport.nasa.gov/image/127727)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System